SUPERSOFT

MUSIC MASTER

MUSIC MASTER

For the Commodore 16 and Plus 4

by

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INTRODUCTION

The Commodore 16 (C16) and Plus/4 computers have simple, but effective, sound generation facilities. Two channels (or voices) of sound are available: the first produces tones whilst the second can produce tones or noise. In theory, 1024 different frequencies can be produced; in practice the usable range for music is about five octaves.

MUSIC MASTER turns the C16 into a simple synthesiser and sequencer. One or both voices can be played in piano fashion using the computer keyboard. Ten pre-programmed rhythms and patterns are available for automatic accompaniment, and one further pattern can be defined by the user.

MUSIC MASTER is also a 'musical wordprocessor'. Its simple to enter music and play it back, and any wrong notes are easily corrected.

GETTING STARTED

LOADING THE PROGRAM

```
Disk version  -  Press shift-RUN/STOP
Tape version  -  Type LOAD <RETURN> then RUN <RETURN>
```

DEMONSTRATION FILES

There are several demonstration files which you can load to help you experiment with MUSIC MASTER. In the tape version there is only one file, recorded directly after the main program. The filenames are as follows:

```
TRITSCH-TRATSCH
BOUREE (BACH)      )
PASSION CHORAL     ) Disk
ODE TO JOY         ) only
ANDANTE IN C       )
```

You must load and run MUSIC MASTER before you attempt to load a music file.

To load TRITSCH-TRATSCH, for example, press shift-S, select the load option, and enter the filename TRITSCH-TRATSCH as prompted. If you are using tape you need only enter '*' since TRITSCH-TRATSCH is the only file. (See page 11 for more details).

When both channels have been read in, press RETURN then shift-SPACE, followed by f2 to start the music playing.

THE MAIN SCREEN

The octave number is displayed in the top left hand corner of the main screen. To select a different octave from the four available press CTRL-1, CTRL-2, CTRL-3 or CTRL-4. Middle C is the lowest note in octave 2.

The top part of the Main Screen describes the status of the two voices and the values of various parameters. MUSIC MASTER starts with voices 1 and 2 turned on, indicated by 'VOICE 1' and 'VOICE 2' being displayed in reverse-field. To turn off voice 1 press '1'; press '1' again to turn the voice back on (use '2' for voice 2).

The output of voice 2 can be either TONE or NOISE; press '3' to change from one to the other. Note that voice 1 can only output TONE.

THE PIANO KEYBOARD

The lower portion of the Main Screen contains a diagram of part of a piano keyboard. Each of the keys (with the exception of the last three in the upper octave) has a counterpart on the Commodore 16 keyboard, as shown by the yellow character displayed above a black key or below a white key. When finding your way about the keyboard it is worth remembering that keys 'F' and 'G' correspond to notes F and G.

When you depress one of the keys a blob appears on the corresponding key of the display, and the frequency (in Hertz, or cycles per second) of the note is displayed alongside the relevant voice indicator(s).

The octave number displayed by MUSIC MASTER refers to the notes in the lower octave of the keyboard, corresponding to keys 'A' to 'K'. The other piano keyboard keys produce notes in the next octave.

PLAYING CHORDS

Usually MUSIC MASTER will play only one note at a time, the same note on each voice which is switched on. If you wish, you can play simple two note chords: enable each voice in turn and play one note of the chord on each. To hear the whole chord press SPACE with both voices enabled.

In the Main Screen, SPACE plays at the displayed frequencies whichever of the two voices are selected.

THE MUSIC SCREEN

The Music Screen allows you to enter and edit tunes played in 'real time' on the keyboard, or else entered more slowly and carefully, possibly from sheet music. The Music Screen is reached from the Main Screen by typing shift-SPACE.

Shift-SPACE can subsequently be used to quit the Music Screen and return to the Main Screen.

In the lower part of the Music Screen is the familiar piano keyboard display. The two independent record channels are represented by two 'staves' in the upper section of the screen. The 'ticks' partition each stave into separate beats, while the reverse-field boxes constitute the 'edit bar', which defines the current beat. Initially the bar contains two colons - the end of recorded note markers - signifying that each channel is empty.

Some important controls are as follows:

> ',' (comma) and '.' (full stop) decrease and increase the tempo by one, providing fine adjustment.
>
> '/' (slash) and '?' (shift-slash) increment and decrement the tempo by fifty, providing coarse adjustment.
>
> CTRL-1,2,...,4 select the octave.
>
> Keys '1' and '2' 'toggle' the corresponding voice on and off as in the Main Screen. The voice indicator is an asterisk displayed on the left edge of the stave. No sound will be produced by a channel if the associated voice is off.
>
> The EDIT channel is selected by pressing shift-1 or 2 and is indicated by the '>' (greater than) marker which appears at the left of the appropriate stave. All editing and recording is performed on the EDIT channel.

RECORD MODE

To enter RECORD mode press f1. Recording always starts from the first 'blank' note after those already recorded (to avoid accidental overwriting of notes recorded previously), so when you press f1 the EDIT channel scrolls to the left at high speed until the last recorded note is reached.

A note is recorded by pressing the appropriate key. The note's name and octave number appear on the bar, then scroll to the left, once for each beat. The duration of the note is also displayed directly beneath the staves. A note cannot be less than 1 or more than 255 beats long. If you release the key before the time for single beat has elapsed, then the note is not recorded.

The space bar takes on a new function in the Music Screen. It provides a means for entering rests which are displayed as '--'.

It is best to select a slow tempo of, say, 75 when first trying out RECORD mode. The keyboard can be played in much the same way as when in the Main Screen, the difference being that your efforts are now being stored in memory.

To get accurate reproduction of a real-time performance you should record using a fairly fast tempo (greater than about 200), so that the resolution is sufficiently fine; and you should play in a legato (smooth) style, because MUSIC MASTER does not record intervals during which no key is depressed. If these suggestions are followed you should find the playback to be indistinguishable from your original performance.

Remember that the shortest note that can be played is a single beat. Beginners are advised to scan the music to find out the shortest note in the piece before starting to record.

PLAYING MUSIC

Notes which have been recorded can be played back by pressing f2. This plays from the current position to the end of the EDIT channel, pauses, and then repeats from the beginning of the channel. RETURN exits to EDIT mode; the only other valid keypresses when in PLAY mode are those which adjust the tempo. The EDIT channel voice is automatically turned on by PLAY, but the other voice is unaffected, so you can play back a single channel or both simultaneously.

EDITING MUSIC

Several commands are available to help edit a recording (all editing is performed on the EDIT channel). CURSOR LEFT moves back to the previous note, exiting RECORD mode; CURSOR RIGHT moves forward by one note. Once the note to be edited has been positioned on the bar, CURSOR UP and CURSOR DOWN can be used to increase and decrease the note over the whole range of the keyboard.

The duration of the note on the bar can be increased or decreased using the function keys HELP and f7 (ie. shift-HELP).

The DEL key deletes the note on the bar. INST allows a single note to be inserted; a space opens up and the new note is recorded in the usual way.

HOME moves back to the start of the EDIT channel; shift-C clears the EDIT channel, and so should be used with caution.

BLOCK EDITING COMMANDS

The most powerful editing commands are the block commands:

REPLICATE - shift-R replicates the block of notes which begins at the current note of the EDIT channel and ends on the last note of the EDIT channel; the replica is placed immediately after the last recorded note in the EDIT channel. Thus a copy is made of all the notes to the right of, and including, the current note.

The replicate command is useful in two respects. First, it makes it easier to record music which has repeats - when you come to the end of a phrase which is to be repeated, move back to the start of the phrase and tap shift-R. Press f1 to continue recording. The second way the command can be used is to set up drum parts and 'sequences' by repeatedly replicating a basic pattern.

DELETE - Press shift-D to delete all the notes to the right of, and including the current note.

TRANSPOSE. - the transpose command raises or lowers all notes to the right of and including the current note by one semitone; f3 transposes up and f6 transposes down. This is perhaps the most useful editing command. Not only does it allow you to transpose an entire piece of music, if, for example, you decide that it would sound better higher or lower, but also, used in conjunction with the replicate command, it is a simple way to introduce key changes.

Note that while the transpose command cannot lower a C in octave 1 (the lowest note) or raise an A in octave 5 (the highest note), it will tranpose any other notes it finds. Use the tranpose command with care when the EDIT channel has notes in octaves 1 or 5.

BOUNCE - shift-B 'bounces' (or copies) the EDIT channel to the other channel and then performs HOME. This allows unison playing, which is particularly effective when used with detuning. Interesting effects can be obtained by bouncing and then making changes to one of the channels: for example you might transpose a channel by two tones so that the two voices play in thirds, or extend the first note of a channel by one or more beats, so that the voices get out of synchronisation (giving a crude echo effect!).

FURTHER POINTS

It is not possible to move past the last recorded note of the EDIT channel. Hence it is not possible to switch channels if doing so would take you past the last recorded note of the new channel.

The end of each channel is indicated by a left arrow. This symbol signals that every available byte of storage for the channel has been used, in which case no more notes can be recorded on the channel.

If the EDIT channel is nearly full then the search for the last recorded note which takes place when RECORD mode is entered may take some time; you can abort the search by pressing the RETURN key. This facility can be used to scan forward through the EDIT channel at high speed; press f1 to begin a scan and RETURN to terminate it.

SPECIAL EFFECTS

ENVELOPES

MUSIC MASTER allows the 'envelope' of the tone to be varied, using ATTACK, DECAY and SUSTAIN parameters. ATTACK is a measure of the time it takes a note to rise from its initial zero volume to the peak volume VL (VL can range between 1 and 8). DECAY is a measure of the time it takes a note to decay from the peak volume VL to the SUSTAIN volume. ATTACK, DECAY and SUSTAIN can each range between 0 and 8. Their values are set using the function keys: f1, f2 and f3 increase ATTACK, DECAY and SUSTAIN respectively by 1, while the shifted function keys f4, f5 and f6 decrease the corresponding parameter by 1. The peak volume VL is adjusted using the cursor-left and cursor-right keys.

The following examples illustrate MUSIC MASTER's envelope facility. Try these out using the piano keyboard in the Main Screen (with VL=6, 7 or 8).

1) A=0, D=2, S=0.
   This envelope gives a percussive 'ping' suitable for playing a tune like Popcorn with TONE, or for getting a drum sound with NOISE.

2) A=5, D=7, S=5.
   This time there is slow attack followed by medium decay to a nonzero volume. The effect is of a church organ or an accordian.

3) A=0, D=7, S=0.
   A piano-like envelope. Try this using both voices together in octave 2 (with TONE for voice 2).

4) A=7, D=0, S=8.
   A 'reverse' envelope, effectively that of the previous example reversed - like a tape played backwards.

5) A=1, D=6, S=5.
   A wind instrument envelope. The initial attack corresponds to the natural delay between the player blowing and the sound being heard.

If SUSTAIN is greater than VL, then the note remains at volume VL (it is as if SUSTAIN were equal to VL).

ENVELOPE CONTROL IN THE MUSIC SCREEN

Some care is required in the use of envelope control in the Music Screen. MUSIC MASTER's envelope facility works by varying the C16's volume control and it is a hardware limitation of the C16 that this one control determines the volumes of both voice 1 and voice 2; since the volumes of the two voices must be the same, both voices are forced to have the same envelope.

MUSIC MASTER applies envelope control to the edit channel only; that is, every time a new note is played on the edit channel, the ATTACK/DECAY cycle is invoked, but the notes on the other channel have no effect on the envelope generator.

On playback it is advisable to select for the edit channel the channel with the fewer notes. For example, if channel 1 contains just one note lasting eight beats and channel 2 has eight separate notes of one beat each, then channel 1 should be the edit channel on playback; otherwise each new note in channel 2 would cause the sustained channel 1 note to be 'repeated', as though channel 1 contained eight separate beats. In this example a high SUSTAIN would be desirable, so as to make all the channel 2 notes audible.

If the envelope has ATTACK=0 and SUSTAIN>=VL then these considerations do not apply and the choice of edit channel makes no difference to the sound on playback.

Study the demonstration files for further hints on how to construct your two-part arrangement for use with a particular envelope. If a little thought is given to the choice of envelope parameters and to the choice of which notes to record on which channel, excellent results can be obtained, despite the inherent limitation of having to share one envelope between two voices.

DETUNING

Detuning is the slight modification of the tones output by voice 2 made by increasing or decreasing the frequency of each note by small amounts (usually less than a semitone).

MUSIC MASTER'S detuning facility enables the C16 to produce a thicker and more impressive tonal quality. The detuning parameter DT specifies the amount by which voice 2 is detuned; it lies in the range 0 to 7.

When voices 1 and 2 are played in unison, but with a DT greater than zero, the sound takes on a rich, animated character. Depending on the degree of detuning, forms of phasing and vibrato may be heard (actually, these are 'beats' produced by notes of similar but unequal frequency).

The detuning parameter is altered using the CURSOR UP and CURSOR DOWN keys. Note that the displayed frequency for voice 2 does not take account of detuning.

BACKGROUND MUSIC AND RHYTHMS

MUSIC MASTER contains ten built-in rhythms and patterns and one which is user-defined; these can be used as an automatic accompaniment while you play from the keyboard in the Main Screen. The background music plays through voice 2 and is selected using the function keys HELP and f7. Press these keys to cycle forwards or backwards through the rhythms; the rhythm number is displayed next to the letters BG.

The tempo of the background rhythms is controlled using the '.' (full stop) and ',' (comma) keys and may vary between 0 and 15. To turn off the background music press shift-2.

Background Music has two main uses. First, it can be used as an automatic drum unit by giving voice 2 the NOISE waveform and selecting one of the first seven rhythms. Second it can be employed as a sequencer by assigning TONE to voice 2 and selecting one of patterns eight to eleven. The preset rhythms and patterns are listed in Appendix B.

The user-defined pattern 11 takes its notes from channel 2 in the Music Screen. To set up a pattern enter the Music Screen and record on channel 2. When rhythm 11 is selected the notes in channel 2 are played one by one, from the beginning of the channel to the end, repeatedly. Effective sequences can therefore be constructed from a mere handful of notes; indeed some of the preset rhythms contain only two notes!

The background rhythms and patterns can be used as a backing track in the Music Screen in the following way. Select one of the preset rhythms 1-10 while in the Main Screen and then press shift-T. This clears channel 2 (so use this command with care) and then copies the current background music to channel 2. (The music is turned off when the task is complete). You can now go to the Music Screen, replicate and/or transpose the pattern or rhythm, and then record on channel 1 using the backing track as a guide. You may wish to alter the timing of the backing track. For example, you might remove the rests (these are present because in the Main Screen the backing needs to be quite staccato so as not to swamp the melody).

Note that background music uses the envelope generator: it invokes the ATTACK/DECAY cycle at the start of each note. A side effect of this is that while you are playing on voice 1 the notes may pulse in time with the background rhythm.

It is interesting to change ATTACK, DECAY and SUSTAIN while background music is playing. For example you can fine tune the envelope parameters while rhythms 1-7 are playing to obtain your preferred drum sound.

Try loading one of the demonstration pieces, playing channel 2 through voice 2 using rhythm 11, and playing along on voice 1 yourself!

SAVING AND LOADING MUSIC

Music you have recorded can be saved to tape or disk so that it may be reloaded and used again. The files created can also be accessed by other software (see the next section).

The storage screen is reached from the Main Screen by pressing shift-S. The screen has a menu containing four options: the fourth of these enables you to change the storage device from cassette to disk or vice versa.

The SAVE MUSIC option works as follows. All the notes stored in channels 1 and 2 are saved, together with the tempo, the EDIT channel number, and all the parameters displayed in the Main Screen, namely, ATT, DEC, SUS, VL, BG, TEMPO, DT, OCT and the status of the two voices. The program will not save an empty channel. When a file is reloaded all the parameters are reinstated and each channel is cleared before the new notes are placed in it. However, if a channel was not saved in the first place then it is left untouched.

The SAVE and LOAD options ask for a filename, which must be at least one character and not more than sixteen characters long. If you enter one of these options by mistake you can escape by pressing ESC or, if no characters have been entered, RETURN.

If you are using disks, the error channel is inspected at appropriate times and any error condition reported. MUSIC MASTER automatically adds the prefix '0:' to filenames entered. Dual disk drive users will not be able to access drive 1.

The usual Commodore pattern matching characters ('*' and '?') can be used to load a file from disk. For example, 'B*' will find 'BACH' or 'BEETHOVEN'.

If an attempt is made to load a file which is not a MUSIC MASTER Music file, MUSIC MASTER aborts the load and displays the message 'FILE TYPE ERROR'.

To help with reloading from cassette, MUSIC MASTER recognises the filename '*' as a signal to load the first file on the tape ('*' is converted to the filename "").

Option three gives disk users access to the disk housekeeping commands. The syntax for these is the same as used by the DOS support program which you are probably familiar with, for example:

'$:BACH*' uses pattern matching to display a directory of files whose names begin "BACH"
'S0:ONLY SIXTEEN' deletes the file "ONLY SIXTEEN"
'N0:MUSIC FILES,M1' formats a new disk "MUSIC FILES" with the ID "Ml"

Refer to your disk drive manual for a full list of these disk commands and their syntax.

To read the error channel just press RETURN; the disk command option is exited by pressing ESC.

ADDING MUSIC TO YOUR OWN PROGRAMS

You can use MUSIC MASTER to create music for use in other programs. The files created by the SAVE MUSIC option are straightforward sequential files which can easily be read, using a BASIC program like the one given below, and incorporated into your own programs.

At this point it is worth explaining how the notes are stored in MUSIC MASTER's record channels. Each note is stored as two bytes; the first byte represents the duration and the second the frequency, but in a coded form. This method has the advantage that it is economical in terms of memory and the disadvantage that a complicated algorithm is required in order to play the notes. Each channel has the same number of bytes allocated to it, 850, so that a maximum of 425 notes can be accommodated in each channel.

The following programs allow you to read a music file and play it using a machine code interrupt routine.

PROGRAM 1 - Machine code routine

```
 50 REM BASIC LOADER FOR INTERRUPT DRIVEN 2-PART MUSIC ON THE C16
 60 REM BY NICK HIGHAM
 70 REM POKE 16080,0:SOUND1,0,0:SOUND2,0,0: REM TURNS MUSIC OFF
 80 REM POKE 16083,10: REM CHANGES THE TEMPO
 90 REM POKE 16084,2: REM CHANGES THE VOLUME
 100 POKE55,239:POKE56,60:CLR: REM LOWER TOP OF MEMORY TO 15599
 105 PRINTCHR$(147);"SETTING UP..."
 115 REM SET UP THE MACHINE CODE
 120 T=0:FOR I=16080 TO 16376:READZ:T=T+Z:POKEI,Z:NEXT
 130 IF T<>36680 THEN PRINT"ERROR: CHECK LINES 1000-1190":END
 190 REM SYS 16101 - WEDGE ON; SYS 16327 - PLAY MUSIC
 1000 REM DATA FOR THE MACHINE CODE INTERRUPT ROUTINE
 1010 DATA 0,1,1,27,5,240,60,153,61,16,32,1,1,4,2,255
 1020 DATA 23,42,3,14,206,173,20,3,201,28,208,8,173,21,3,201
 1030 DATA 63,208,1,96,120,173,20,3,141,227,62,173,21,3,141,228
 1040 DATA 62,169,28,141,20,3,169,63,141,21,3,88,96,120,173,227
 1050 DATA 62,141,20,3,173,228,62,141,21,3,88,96,173,208,62,208
 1060 DATA 3,108,227,62,206,224,62,240,3,108,227,62,173,211,62,141
 1070 DATA 224,62,169,1,141,223,62,174,223,62,189,209,62,240,86,222
 1080 DATA 219,62,208,81,189,217,62,73,255,45,17,255,141,17,255,138
 1090 DATA 10,170,32,190,63,240,70,172,223,62,153,219,62,32,190,63
 1100 DATA 141,225,62,32,190,63,41,3,141,226,62,13,225,62,240,37
 1110 DATA 174,223,62,173,225,62,157,14,255,188,221,62,185,14,255,41
 1120 DATA 252,13,226,62,153,14,255,173,17,255,41,112,13,212,62,29
 1130 DATA 217,62,141,17,255,206,223,62,16,157,108,227,62,189,213,62
 1140 DATA 149,208,189,214,62,149,209,161,208,208,172,181,208,
          208,2,214
 1150 DATA 209,214,208,169,255,172,223,62,153,219,62,76,149,63,246,208
 1160 DATA 208,2,246,209,161,208,96,169,0,141,208,62,162,1,138,10
 1170 DATA 168,56,185,213,62,233,1,153,208,0,185,214,62,233,0,153
 1180 DATA 209,0,202,16,233,169,0,141,17,255,169,1,141,219,62,141
 1190 DATA 220,62,141,224,62,141,208,62,96
```

First load and run the program above, then use the program below to read and play a music file. All the information you should need is given in the REM statements.

PROGRAM 2 - Music Master file reader

```
 100 REM UTILITY TO READ A MUSIC MASTER 16 MUSIC FILE
 102 REM AND POKE THE DATA INTO MEMORY, FOR USE WITH THE
 104 REM INTERRUPT DRIVEN MUSIC ROUTINE
 120 N=300: REM SET N TO MAXIMUM NUMBER OF NOTES PER CHANNEL EXPECTED.
 125 REM N<=425 BUT WASTEFUL TO DIM TO THIS MAX POSSIBLE VALUE.
 130 :
 135 PRINTCHR$(147);"MUSIC MASTER UTILITY":PRINT
 140 DIM I,J,N,Z,C,D,F$,Z$,NT,OC,LN,L%,H%,C2
 150 DIM D%(N,2), NV(N,2), FQ(57), LN%(2)
 160 REM FOR THE I'TH NOTE IN CHANNEL J
 170 REM D%(I,J) IS THE DURATION (1 TO 255)
 180 REM AND NV(I,J) IS THE NOTE VALUE TO BE USED IN A SOUND STATEMENT
 190 :
 200 FOR I=0 TO 57:READ FQ(I):C=C+FQ(I):NEXT
 210 IF C<> 44692 THEN PRINT"CHECKSUM ERROR: CHECK DATA
     STATEMENTS":END
 220 :
 230 DATA 169,217,262,305,345,383,419,453,485,516,544,571
 240 DATA 597,621,643,665,685,704,722,739,755,770,784,798
 250 DATA 810,822,834,844,854,864,873,881,889,897,904,911
 260 DATA 917,923,929,934,939,944,948,953,957,960,964,967
 270 DATA 971,974,976,979,982,984,986,988,990,992
 280 :
 290 INPUT"FILENAME";F$
 300 INPUT"TAPE OR DISK";Z$
 310 IFLEFT$(Z$,1)<>"D"THEN OPEN 1,1,0,F$:GOTO 340
 320 OPEN 1,8,2,"0:"+F$+",S,R"
 330 :
 340 INPUT#1,Z$: IFZ$="MUSIC" THEN 390
 350 PRINT"*** FILE TYPE ERROR ***":CLOSE 1
 360 IFLEFTS(ZS,1)="D"THEN PRINTDS$
 370 END
 380 :
 390 INPUT#1,J:IF J<0 THEN 490
 400 PRINT"LOADING CHANNEL";J
 410 FOR I=1 TO N:INPUT#1,D,C
 420 IF D=-1 THEN LN%(J)=I-1: GOTO 390
 430 D%(I,J)=D:OC=INT(C/32):NT=C AND 31
 440 IF NT=22 THEN NV(I,J)=0:GOTO 470: REM REST
 450 IF NT>11 THEN NT=NT-12:OC=OC+1
 460 NV(I,J)=FQ(NT+12*(OC-1))
 470 NEXT I
 490 CLOSE 1
 500 REM ATT,DEC,SUS,DT,BG ETC. ARE NOT READ IN BY THIS PROGRAM
 510 :
 600 LN=LN%(1)*3+1+LN%(2)*3+1
 610 PRINT:PRINT"MUSIC DATA WILL OCCUPY";LN;"BYTES"
 615 PRINT"TOP OF MEMORY =";PEEK(55)+256*PEEK(56)
 617 PRINT"TOP OF ARRAYS =";PEEK(49)+256*PEEK(50)
 618 PRINT"START ADDRESS IN DECIMAL"
 620 INPUT"(0 TO QUIT)";SA:Z=SA:IF Z=0 THEN STOP
```

```
640 FOR I=1 TO 2:IF LN%(I)=0 THEN 690
650 FOR J=1 TO LN%(I)
660 POKEZ,D%(J,I):H%=NV(J,I)/256:L%=NV(J,I)-256*H%
670 POKEZ+1,L%:POKEZ+2,H%:Z=Z+3
680 NEXT J
690 POKEZ,0:Z=Z+1: REM END OF CHANNEL MARKER
700 IF I=1 THEN C2=Z
710 NEXT I
720 :
730 PRINT:PRINT"DATA OCCUPIES ADDRESSES";SA;"TO";Z
740 PRINT"CHANNEL 1 DATA STARTS AT";SA
750 PRINT"CHANNEL 2 DATA STARTS AT";C2
760 PRINT:PRINT"PLAY THE MUSIC (M/C ROUTINE"
770 INPUT"MUST BE IN MEMORY)  Y/N";Z$
780 IF LEFT$(Z$,1)<>"Y"THEN END
790 :
800 REM PLAY THE MUSIC
810 Z=16080
820 H%=SA/256:L%=SA-256*H%:POKE Z+5,L%:POKE Z+6,H%: REM LOW1, HIGH1
830 H%=C2/256:L%=C2-256*H%:POKE Z+7,L%:POKE Z+8,H%: REM LOW2, HIGH2
835 INPUT"TEMPO :";J:POKE Z+3,J
840 SYS 16101: REM WEDGE ON
850 SYS 16327: REM MUSIC ON
```

The third program will create DATA statements from files which have been read in by Program 2. This data can be subsequently POKED into memory and played using Program 1. (See also lines 730-850 of program 2 for more information)

PROGRAM 3 - Data creator

```
0 INPUT"ENTER FIRST AND LAST BYTES";S;E
1 INPUT"FIRST DATA LINE";L:IFL<10THEN1
2 I=S:J=0:PRINTCHR$(147):PRINT:PRINT
3 L$=MID$(STR$(L),2):C=LEN(L$):PRINTL$"DATA";:L=L+10
4 I$=MID$(STR$(PEEK(I)),2):PRINTI$;:C=C+LEN(I$)+1:I=I+1:IFI>ETHEN
  PRINT:GOTO7
5 IFC<72THENPRINT",";:GOTO4
6 J=J+1:PRINT:IFJ<9THEN3
7 B=9:IFI<=E THEN S=I:B=2:PRINT"S="S":E="E":L="L":";
8 PRINT"GOTO"B:POKE239,10:FORJ=0TO9:POKE1319+J,13:NEXT:PRINTCHR$(19)
9 END
```

COMPATIBILITY WITH MUSIC MASTER 64

MUSIC MASTER was originally developed for the Commodore 64, which has a superior sound generator to the C16. The 64 has three voices, four different waveforms and programmable ATTACK, DECAY, SUSTAIN and RELEASE.

Should you decide to 'upgrade' to the Commodore 64 and MUSIC MASTER 64 then all your C16 Music files can be transferred to the 64, since the files of the two versions of MUSIC MASTER are compatible (and you will be able to add a third part to your arrangements!). Conversely, MUSIC MASTER 16 can read Music files from the 64 provided that channels 1 and 2 contain no more than 425 notes; channel 3 is ignored.

APPENDIX: SUMMARY OF OPTIONS AND COMMANDS

In general, when altering parameters an unshifted key gives an increase while a shifted key gives a decrease.

MAIN SCREEN COMMANDS

1,2	Select/cancel VOICE - turn the voice on if it is off, or off if it is on
3	Waveform of voice 2 - toggle between NOISE and TONE
CTRL-1,2,3,4	Select OCTAVE
SPACE	Play CHORD - the active voices are played at the displayed frequencies
f1/f4	Adjust ATTACK
f2/f5	Adjust DECAY
f3/f6	Adjust SUSTAIN
CURSOR LEFT/RT	Adjust VOLUME
CURSOR UP/DOWN	DETUNE voice 2
HELP/f7	BACKGROUND MUSIC - select background rhythms and patterns for voice 2. Shift-2 turns off background music
',' and '.'	Adjust the TEMPO of the background music
shift-T	BACKING TRACK - if background music is playing this command clears channel 2 in the Music Screen and copies the rhythm or pattern to channel 2
shift-S	STORAGE SCREEN - load or save a music file using tape or disk; perform disk housekeeping operations
shift-SPACE	Exit to MUSIC SCREEN

MUSIC SCREEN COMMANDS

shift-1,2	Select edit channel - the edit channel is indicated by the '>' marker
1,2	Select/cancel VOICE - an asterisk is displayed alongside the channel to indicate that the corresponding voice is turned on
CTRL-1,2,3,4	Select OCTAVE
, . / ?	Adjust TEMPO - the first two keys alter the tempo by plus or minus one, the second two by plus or minus fifty
f1	Enter RECORD mode - RETURN terminates the search for the last recorded note
SPACE	Record a REST
f2	PLAY music - RETURN is used to quit PLAY mode
INST/DEL	INSERT/DELETE a note
shift-C	CLEAR edit channel
HOME	Go to START of edit channel
CURSOR LEFT/RT	Move FORWARD/BACK one note
HELP/f7	Change note DURATION
CURSOR UP/DOWN	Change note VALUE
shift-R	REPLICATE from current note onwards
f3,f6	TRANSPOSE from current note onwards - raise or lower the following notes by a semitone
shift-D	DELETE from current note onwards
shift-B	BOUNCE edit channel - copies the EDIT channel to the other channel and performs HOME
shift-SPACE	EXIT to the MAIN SCREEN